September 8, 2016

Indian Creek Watershed Nutrient TMDL – Second Reconsideration Decision

Summary:

On December 23, 2014, Mr. John Hall on behalf of the Telford Borough Authority (Telford) submitted a second request for reconsideration and withdrawal of the Indian Creek nutrient TMDL ("2014 reconsideration request letter") to the U.S. Environmental Protection Agency (EPA).

This document presents EPA's consideration of the additional information and comments received in the 2014 reconsideration request letter, and EPA's review of the Indian Creek nutrient TMDL in light of that information. Based on that review, EPA has determined that the nutrient TMDL remains technically sound. EPA therefore denies the request of Telford Borough Authority dated December 23, 2014 to revise, amend, defer and/or withdraw the Indian Creek Watershed nutrient TMDL.

In addition, on August 12, 2014, EPA received a letter from Mr. Mark D. Fournier, Borough Manager, Telford Borough Authority, seeking clarification on three specific points concerning the Indian Creek nutrient TMDL. EPA is also responding to the three questions posed by Telford in its August 12, 2014 letter.

Background:

On June 30, 2008, EPA established nutrient and sediment TMDLs for the Indian Creek watershed in Pennsylvania (*Nutrient and Sediment TMDLs for the Indian Creek Watershed, Pennsylvania Established by the U.S. Environmental Protection Agency*). [1]

The Indian Creek watershed drains approximately seven square miles in Montgomery County, PA and includes portions of eight municipalities. Various degrees of residential development (low, medium and high intensity residential) are scattered throughout the watershed with the middle portion mostly pasture. EPA assigned TMDL wasteload allocations (WLAs) to three wastewater treatment plants (WWTPs) in the watershed: Telford Borough Authority, Pilgrim's Pride, and Lower Salford Authority (Harleysville sewage treatment plant (STP)). Because the entire watershed is served by four Municipal Separate Storm Sewer Systems (MS4s), EPA assigned all allocated loads to the WLA category and assigned WLAs to the four MS4 jurisdictions of Lower Salford, Telford, Souderton, and Franconia.

EPA developed nutrient and sediment TMDLs for the Indian Creek watershed at the request of the Pennsylvania Department of Environmental Protection (PADEP), and pursuant to requirements of the Pennsylvania TMDL Consent Decree, American Littoral Society v. EPA, Civil No. 96-489 (E.D.Pa.) (J. Katz). The consent decree required EPA to establish TMDLs for water quality limited segments (WQLSs) identified on Pennsylvania's 1996 CWA section 303(d)

[1] *Nutrient and Sediment TMDLs for the Indian Creek Watershed, Pennsylvania Established by the U.S. Environmental Protection Agency, June 30, 2008*, (USEPA 2008) accessed at: http://www.epa.gov/tmdl/nutrient-and-sediment-tmdls-indian-creek-watershed-pennsylvania

list of impaired waters. Pennsylvania identified Indian Creek on its 1996 list as a WQLS impaired for aquatic life uses by an unknown "cause" and "source unknown," Pennsylvania's 2004 list refined this listing as impaired by nutrients, identified the source as municipal point sources, and added an impairment for siltation with the source being from agriculture, small residential runoff and urban runoff/storm sewers.

EPA established the Indian Creek TMDLs to address WQLSs listed on Pennsylvania's 303(d) list that were not meeting aquatic life uses as a result of siltation (sediment) and nutrients. As explained in detail in the Indian Creek TMDL report and supporting documents, EPA relied on extensive water quality data and expert scientific analysis in establishing these TMDLs. Please refer to the Indian Creek Watershed TMDL (USEPA 2008) for further details.

The Indian Creek TMDL has been challenged in two lawsuits. Plaintiffs Lower Salford Township Authority, Lower Salford Township, Franconia Sewer Authority and Franconia filed a Complaint against EPA for both nutrient and sediment TMDLs on October 18, 2011. *Lower Salford Township Authority et al. v. EPA*, Civil Action No. 2:11-cv-06489-CDJ (E.D.PA). In November 20, 2012 Telford Borough Authority filed an additional challenge to the Indian Creek nutrient TMDL, *Telford Borough Authority v. EPA*, Civil No. 2:12-cv-06548-CDJ (E.D. PA) (*Telford)*.

EPA previously issued a decision on March 21, 2014 in response to requests by the Telford Borough Authority and Lower Salford Township for reconsideration of the nutrient and sediment TMDLs for Indian Creek. For the nutrient TMDL, EPA considered the additional information and comments received, reviewed the nutrient TMDL in light of that information, and determined that the nutrient TMDL remains technically sound. EPA therefore denied the requests to withdraw the nutrient TMDL. For the sediment TMDL, EPA's analysis of the Indian Creek sediment TMDL addressed concerns that the reference watershed approach and sediment loading rates used should be revisited. Based on that analysis, EPA filed a request dated April 1, 2014 seeking a voluntary remand of the Indian Creek sediment TMDL in the case *Lower Salford Township Authority et al. v. EPA*, Civil Action No. 2:11-cv-06489-CDJ (E.D.PA). The U.S. District Court for the Eastern District of Pennsylvania granted that request by Order dated April 3, 2014. EPA's March 21, 2014 reconsideration decision can be found at: http://www.epa.gov/tmdl/nutrient-and-sediment-tmdls-indian-creek-watershed-pennsylvania

EPA is making this decision today to respond to a second request for reconsideration and withdrawal of the Indian Creek nutrient TMDL submitted by Mr. John Hall on December 23, 2014 on behalf of the Telford Borough Authority (Telford).[2]

In this document, EPA is addressing the technical issues raised about the Indian Creek nutrient TMDL by Telford in Mr. Hall's 2014 reconsideration request letter. In addition to raising technical issues regarding the validity of these TMDLs, Telford raised – in their complaints and

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[2] Over the years, several municipal entities including Telford Borough Authority, Lower Salford Township Authority, Lower Salford Township, Franconia Township and Franconia Sewer Authority have submitted many comments to (and had many conversations with) EPA – both before and after EPA's establishment of the Indian Creek nutrient and sediment TMDLs. EPA has prepared the attached Chronology of Contacts (Attachment A) to provide an abbreviated summary of those comments and communications.

elsewhere – a number of purely legal concerns about these TMDLs, e.g., whether establishment of the TMDLs unlawfully revised Pennsylvania's water quality standards and whether EPA lawfully established the TMDLs in the first place. EPA is not addressing such purely legal claims in this document. Should it be necessary, EPA will respond to such legal issues in appropriate motions and briefs filed in the pending lawsuits challenging the TMDLs cited above. Instead, this document responds to the technical concerns raised against the Indian Creek nutrient TMDL in the 2014 reconsideration request letter, and presents EPA's conclusions regarding their merits.

Indian Creek Watershed Nutrient TMDL Reconsideration:

EPA's second reconsideration of the nutrient TMDL in Indian Creek is based directly on the evidence and letter submitted by Telford as cited below:

> December 23, 2014 Letter from John Hall on behalf of the Telford Borough Authority to EPA Region 3 Water Protection Division Director Jon Capacasa and to PADEP Director for the Bureau of Point and Non-Point Source Management Lee McDonnell (Hall & Associates, 2014). This letter included three exhibits:
>
> a. Exhibit 1 contained a report entitled "Technical Report – Indian Creek Watershed Periphyton Density and Phosphorous Concentration Survey" completed by Kleinfelder, Inc. (referred to as "Kleinfelder Report").
>
> b. Exhibit 2 contained a table of literature citations entitled "Nutrient Effect on Periphyton Growth in Streams."
>
> c. Exhibit 3 contained an article entitled "Mercury Falling: How a facility upgrade intended to reduce algal growth resulted in unintended (yet favorable) consequences" from *Water, Environment and Technology Journal.*

In the following section, EPA presents Telford's conclusions regarding the Indian Creek nutrient TMDL, and EPA's response to those conclusions.

Telford's Conclusion 1:
"Concentrations of TP [total phosphorus] *are higher in the background (upstream) sections of Indian Creek than they are in Telford's discharge itself. TP at the upstream station averaged <0.170 mg/l while the Telford effluent averaged <0.085 mg/l. Thus it is apparent that 40 µg/l instream TP concentration cannot be achieved in this system and that background TP levels are elevated as previously stated by the Authority."*

<u>Response to Conclusion #1:</u>

Using the results of the data of the upstream station, Telford argues that the high "background (upstream)" loads of total phosphorus (TP) (above Telford) make it impossible to achieve EPA's target in-stream concentration of 40 µg/l (or 0.04 mg/l) TP below Telford. EPA TMDL regulations recognize the concept of "background" concentrations of a pollutant but only in context of "natural background", the background concentration that would be present but for the human caused conditions. 40 C.F.R. 130.2(e) (definition of "load"); 130.2(i) (definition of "TMDL"). As described below, Telford did not show that this high background concentration was natural. As explained in more detail below, EPA finds that the TMDL as well as current information demonstrates there are multiple sources of human caused activities causing excess nutrients to be delivered to the portion of Indian Creek above Telford's WWTP discharge (e.g., MS4, agricultural activities etc,). As called for in the TMDL, such sources may be controlled to reduce the levels of nutrient discharged into Indian Creek. While EPA agrees with Telford that the upstream concentrations of TP are too high, EPA disagrees with the premise that the "background" concentrations are natural and cannot be controlled. Based on the TMDL analysis, implementation of controls to reduce nutrient discharges to Indian Creek are expected to reduce the instream levels of TP to the TMDL endpoint level of 0.04 mg/l.

As evidence that TP concentrations are higher upstream of Telford's WWTP, Telford presented a graph labeled "Upstream Sampling Telford Borough Authority," which purports to show monitoring data for TP in mg/l collected between April 2014 and October 2014 from (1) the waterbody upstream of Telford's WWTP and (2) Telford's WWTP effluent. As a preliminary matter, it should be noted that Telford does not include important contextual information about the graph such as the data itself used in the graph, the precise location of the upstream and effluent samples cited in this graph, the sampling frequency, the timing of sampling of both sites, the method of collection (grab vs composite sample), analysis of the samples, and the quality assurance procedures followed to collect and analyze the data. Accordingly, in evaluating Telford's claims, it is not clear how much, if any, weight should be given to the graph.

To fully understand the significance and relevance of the graph, Telford would need to provide additional information about the data, quality assurance procedures used to collect and analyze the samples (to assure its efficacy), the monitoring location of upstream and effluent sites, additional data downstream of the WWTP (to understand how the WWTP causes and contributes to the TP load), stream flow and precipitation events during the time of sampling.

Assuming for purposes of this response that the data in the graph is reliable, the graph depicts TP levels upstream of the Telford WWTP ranging from 0.1 mg/l to 0.6 mg/l. The TP levels in the WWTP effluent range from 0.04 mg/l to 0.15 mg/l. In addition, EPA has reviewed the discharge monitoring reports (DMRs) of Telford WWTP from April 2014 to October 2014 and the average TP in the effluent discharge is 0.1 mg/l. The data presented in the graph appear to demonstrate that TP levels for both the effluent and upstream water quality are above the instream target of 0.04 mg/l (or 40 µg/l) TP established by the TMDL. According to the graph, and as suggested by Telford, the WWTP effluent appears to have concentrations less than the upstream site.

EPA disagrees with Telford's conclusions that because the presented data suggests upstream TP levels are higher than the effluent discharge, the 0.04 mg/l instream TP concentration cannot be achieved in this system. First, EPA does not dispute that TP concentrations are above 0.04 mg/l upstream (and downstream) of the WWTP and that TP loads are coming from sources other than the WWTP such as a combination of point source MS4s, nonpoint land sources and natural background sources. The watershed is severely impaired by nutrients and it is not surprising to find high TP levels upstream of the WWTP. As noted in the Indian Creek TMDL document, (summarized in Table 1 below), WWTPs as well as land sources contributing to MS4s are discharging TP throughout the watershed both upstream and downstream of the Telford WWTP. The TMDL sets out expectations for each of those sources to reduce their loads. Figure 1 below illustrates that the land uses upstream of Telford's WWTP outfall included Low Intensity Residential (30.5%), High Intensity Residential (38.8%), High Intensity Commercial/Industrial (15.7%), Paved Roads (2.7%), Agriculture/Pasture (7.6% combined), and Forest/Grasslands (4.5% combined) and comprise portions of the MS4 jurisdictions of Telford, Souderton and Franconia. As calculated in the TMDL, each of those land sources are discharging TP into Indian Creek via stormwater runoff and MS4 discharges during storm events. Because the entire watershed is served by the four MS4s, EPA assigned all allocated loads to the WLA category and assigned WLAs to the four MS4 jurisdictions of Lower Salford, Telford, Souderton, and Franconia. Table 2 shows the four MS4's WLAs divided by land source as described in the Indian Creek TMDL document.

Table 1. Existing, TMDLs, and Maximum Daily Total Phosphorus WLAs for Permittees[3]

NPDES ID	Facility/Township	Existing Load (lb/yr)	TMDL WLA (lb/yr)	Maximum Daily (lb/day)	Percent Reduction
PA0036978	Telford Borough Authority	5695.66	156.10	0.846	97%
PA0054950	Pilgrim's Pride	791.53	20.60	0.181	97%
PA0024422	Lower Salford Authority (Harleysville STP)	1066.16	101.30	0.694	90%
MS4	Lower Salford	803.32	262.89	1.614	67%
MS4	Souderton	49.40	42.83	0.263	13%
MS4	Telford	118.18	102.45	0.629	13%
MS4	Franconia	2863.44	736.09	4.520	74%
Total WWTP WLA		**7553.35**	**278.00**	**1.721**	**96%**
Total MS4 WLA		**3834.34**	**1144.25**	**7.026**	**70%**
Total WLA		**11387.69**	**1422.25**	**8.747**	**88%**

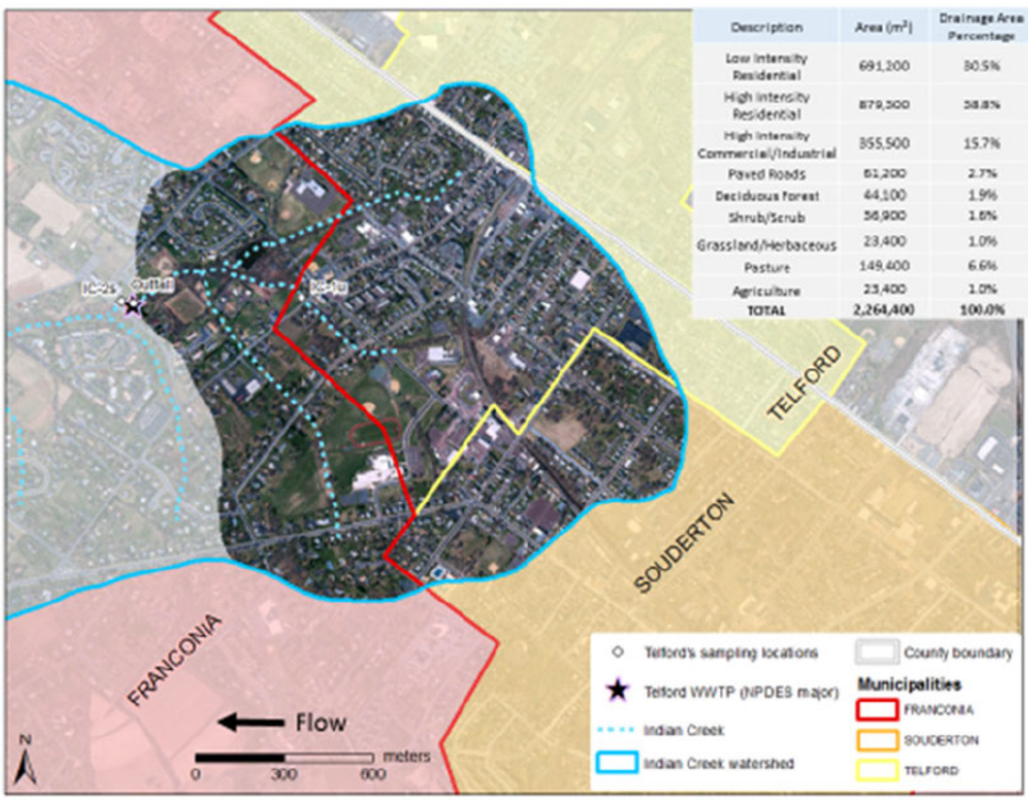

Figure 1. Map of the Indian Creek drainage area upstream of the Telford WWTP outfall including the drainage area percentage of landuses and MS4 boundaries.

[3] *Errata for the Nutrient and Sediment TMDLs for the Indian Creek Watershed, Pennsylvania Established by the U.S. Environmental Protection Agency, June 30, 2008*, dated May 19, 2015 (USEPA 2015) accessed at: http://www.epa.gov/TMDLs/nutrient-and-sediment-TMDLs-indian-creek-watershed-pennsylvania

Table 2. MS4 Related WLAs for Total Phosphorus[4]

Landuse/Source	LOWER SALFORD	SOUDERTON	TELFORD	FRANCONIA
Agriculture	72.80	3.27	14.18	208.31
Pasture	63.16	5.23	5.61	176.95
Paved_Roads	0.30	0.17	0.33	0.31
Bare Rock/Sand/Clay	0.07	0.00	0.00	0.99
Deciduous Forest	0.07	0.00	0.01	0.21
Evergreen Forest	0.00	0.00	0.00	0.00
Wetlands	0.00	0.00	0.00	0.00
High Intensity Residential	16.63	8.91	18.60	35.77
High Intensity Commercial/Industrial/Transport	18.45	12.05	34.49	30.63
Low Intensity Residential	37.51	9.93	22.11	105.35
Groundwater	53.90	3.27	7.12	177.57
MS4 WLAs (lb/yr)	**262.89**	**42.83**	**102.45**	**736.09**
WWTPs WLAs (lb/yr)	**101.30**		**156.10**	**20.60**
Point Source WLA Summary (lb/yr)				**1,422.25**
5% MOS				**79.91**
6% Future Growth				**95.892**
Total Allowable Load (lb/yr)				**1,598.05**
Existing Load (lb/yr)				**11,389.11**

If Telford had provided stream flow and precipitation data to augment the graph they provided, EPA would expect to see at least one or two rain events in the watershed that would explain the elevated TP spikes in the upstream data points represented in the graph. In addition, and again not provided by Telford, TP data points downstream of the WWTP would have given EPA additional information on how Telford's TP discharge is contributing to the TP load in the stream. The current TMDL provides TP reductions for all sources that, if achieved, will reduce the instream TP levels in Indian Creek both upstream and downstream of the Telford WWTP to the TMDL's endpoint to ensure attainment of water quality standards. Therefore, based on the graphical information provided by Telford, EPA concludes that the graph supports the TMDL's conclusions that MS4 permittees also cause and contribute to the nutrient impairment and reductions from those sources are necessary. Telford has presented no evidence to suggest that the upstream TP levels are merely natural background or that they are not capable of being reduced to the levels contemplated by the TMDL if the TMDL is effectively implemented.

Telford's Conclusion #2:
"Excessive plant growth is occurring in Indian Creek regardless of TP concentrations and Telford's wastewater treatment plant reductions; the chlorophyll–a level has no relationship to TP concentrations in Indian Creek. During the 9/24/14 periphyton survey, periphyton levels of 300-335 mg/m^2 chl-a were observed in a range of 0.10-0.24 mg/l TP. At the remaining survey

[4] Ibid

sites, higher periphyton levels between 490-825 mg/m^2 chl-a were observed in a slightly lower range of 0.06-0.18 mg/l TP. Periphyton remained very high on the unnamed tributary where the now discontinued, Pilgrim's Pride discharge had been located. Periphyton reductions are not occurring as predicted in the TetraTech modeling, confirming that model is not properly calibrated. Even zero discharge cannot control periphyton growth.

Chlorophyll-a levels are affected by the percentage of canopy. The three periphyton survey samples at 0% unshaded sites averaged 372 mg/m^2 chl-a while the three survey samples at sites of at least 70% unshaded averaged 616 mg/m^2."

<u>Response to Conclusion #2:</u>
Telford has reached a number of conclusions based on the one day of data presented in the Kleinfelder Report. EPA will address each conclusion individually.

To seek to prove that excess plant growth is occurring in Indian Creek regardless of TP concentrations, Telford presented in the Kleinfelder Report data of periphyton density and phosphorus concentrations collected on September 24, 2014 at six locations within the Indian Creek watershed. The monitoring data purports to show elevated periphyton biomass levels of 300 to 335 mg/m^2 chlorophyll *a* at locations where one-day TP water column samples measured in a range of 0.10 to 0.24 mg/l TP. At other survey locations, higher periphyton levels of 490 to 825 mg/m^2 were observed where TP was measured in a slightly lower range of 0.06 to 0.18 mg/l TP. Table 3 of the Kleinfelder Report shows that survey location IC-1u, located approximately 2,000 feet upstream of Telford's WWTP effluent, had an instream TP concentration of 0.232 mg/l, while survey location IC-2s, located approximately 140 feet downstream of Telford's WWTP effluent, had an instream TP concentration of 0.109 mg/l. To help review data within the context of sampling points and TP sources in the watershed, Figure 2 illustrates the Indian Creek watershed with land use information, MS4 boundaries, National Pollutant Discharge Elimination System (NPDES) permittees, Telford's sampling locations, and PADEP sample locations.

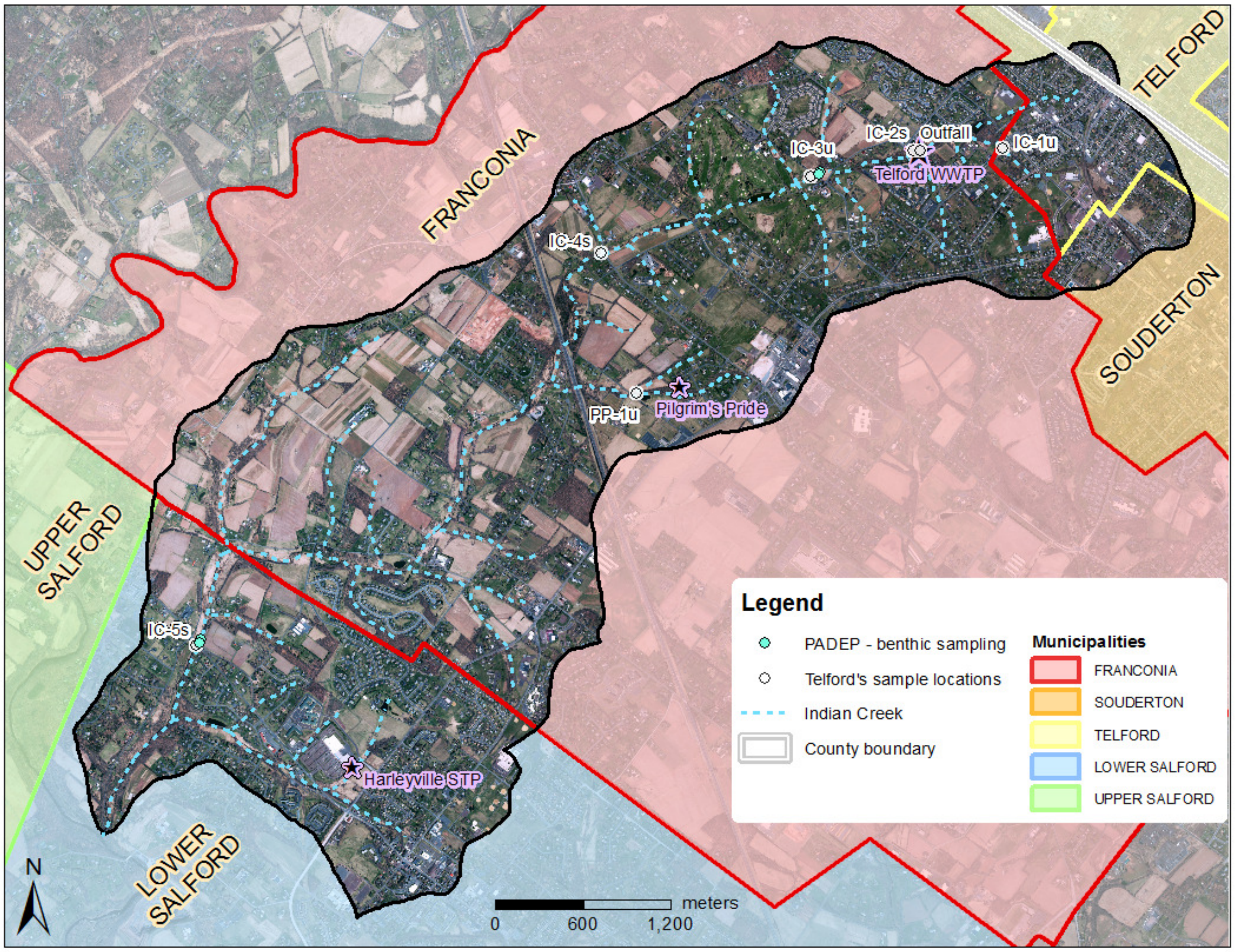

Figure 2. Indian Creek Watershed showing landuse information, MS4 boundaries, NPDES permittees, Telford's sampling locations and PADEP sampling locations.

EPA reviewed the periphyton density and phosphorus concentration data presented in the Kleinfelder Report and determined that Telford's conclusion that periphyton chlorophyll *a* levels have no relationship to TP concentrations is not supported by the scientific literature. There is an abundance of literature and studies that clearly show the correlation between chlorophyll *a* levels and TP concentrations in waterbodies. For a sampling of these citations, EPA points Telford to EPA's document *Nutrient Criteria Technical Guidance Manual Rivers and Streams* (EPA-822-B-00-002) (USEPA July 2000), which provides:

> *"Nutrient enrichment frequently ranks as one of the top causes of water resource impairment. . . The USEPA reported to Congress that of the systems surveyed and reported impaired, 40 percent of rivers, 51 percent of lakes, and 57 percent of estuaries listed and nutrients as a primary cause of impairment (USEPA 1996) Nutrient impaired waters can cause problems that range from annoyances to serious health concerns (Dodds and Welch 2000). Nuisance levels of algae and other aquatic vegetation (macrophytes) can develop rapidly in response to nutrient enrichment when other factors (i.e., light, temperature, substrate, etc.) are not limiting. High macrophyte growth can interfere with aesthetic and recreational uses of stream systems (Welch 1992). Algae in*

> *particular can grow rapidly when the nutrients N and P (primary nutrients that most frequently limit algal growth . . . are abundant, often developing into single or multiple species blooms. Algal bloom development involves complex relationships that are not always well understood. However, the relationship between nuisance algal growth and nutrient enrichment in stream systems has been well-documented in the literature (Welch 1992; Van Nieuwenhuyse and Jones 1996; Dodds et al. 1997; Chetelat et al. 1999).*

In addition to EPA's Nutrient Criteria Guidance, the documents that Telford itself presented to EPA for our consideration, all state clearly the relationship between nutrients and algal growth. Below are excerpts from the conclusions of four of the documents presented to EPA by Telford:

> All available evidence suggests that neither invertebrate grazers nor high discharge events (Hall & Likens 2001) significantly reduce periphyton biomass. Light and nutrient availability are both potentially important controls on periphyton growth.
> *Controls on periphyton biomass in heterotrophic streams,* Emily S. Bernhardt and Gene E. Likens (2004)

> Phosphorus concentration also limited growth rate: growth increased hyperbolically with increasing soluble reactive phosphorus (SRP), reaching a threshold of growth saturation between 22 and 82 μg L^{-1}). . . Periphyton phosphorus content was strongly and nonlinearly related with SRP, reaching a maximum at 82 μg L^{-1})
> *Phosphorus and light colimit periphyton growth at subsaturating irradiances;* Walter R. Hill and Shari E. Fanta (2008)

> If the ecology of the Thames is to reach . . . "good ecological status", then both SRP [soluble reactive phosphorus] concentration reductions (probably to below 100 µg/l) and increased shading will be required.
> *Nutrient and light limitation of periphyton in the River Thames; implications for catchment management; Bowes, M.J. et.al. (2012).*

> Eutrophication and deforestation are two major factors currently affecting lotic ecosystems. Because these disturbances increase resource levels, they can modify the trophic structure of the whole ecosystem. The limiting role of light and nutrients for primary producers has been widely discussed for the last 20 years. Changes in light and nutrient concentration usually have a significant effect on periphyton and invertebrates.
> *Responses of a lake outlet community to light and nutrient manipulation: effects on periphyton and invertebrate biomass and composition*; Nathalie Bourassa and Antonella Cattaneo (2000)

Importantly, each of the documents presented to EPA by Telford are unanimous on one thing: <u>but for the presence of excess nutrients, there would be no excess algal growth</u>. While there may be environmental factors such as light that can influence the impact of excess nutrients, the underlying cause of the excess algal growth is excess nutrients. There is no scientific debate on this point. Therefore, for the purposes of this reconsideration document, EPA will review whether the concentrations of TP in Indian Creek are causing an algal problem, not whether TP levels have a relationship to chlorophyll *a*.

Relying on the well-supported findings in the scientific literature that elevated TP can lead to nuisance algal growth, EPA reviewed the Kleinfelder Report to determine the level of TP and algal growth in Indian Creek. For that single day of sampling, Table 3 of the Kleinfelder Report shows that TP concentrations exceed the TMDL's endpoint of 0.04 mg/l TP at all six survey locations, with TP concentrations ranging from 0.07 mg/l to 0.23 mg/l. EPA concludes that the instream TP levels are high enough to support excess algal growth on that one day of sampling (Welch 1992, Van Nieuwenhuyse and Jones 1996, Dodds et al. 1997, Chetelat et al. 1999, Hausmann, et al. 2016). Further, the report presented chlorophyll *a* densities ranging from 308 mg/m^2 to 824 mg/m^2 – all well above the level of chlorophyll *a* density sufficient to support nuisance algal growth (Dodds and Welch 2000, Suplee et al. 2009). For context, nuisance or excessive periphyton biomass is considered to occur when maximum chlorophyll *a* (representing the periphyton) exceeds 150 to 200 mg/m^2 (Dodds et al. 1998, Suplee et al. 2009), although concentrations from 50 to 100 mg/m^2 have also been indicative of nuisance concentrations (Horner et al. 1983, Nordin 1985, Welch et al. 1988). Therefore, EPA concludes from the data Telford presents that there is excessive periphyton growth within Indian Creek watershed and that on September 24, 2014 the TP levels are sufficient to support excess algal growth.

Telford admits that "Excessive plant growth is occurring in Indian Creek" but draws the wrong conclusions about the cause of that excessive plant growth. Telford states in its conclusion that during the September 24, 2014 periphyton survey, periphyton levels of 300-335 mg/m^2 were observed in a range of 0.10-0.24 mg/l TP. At the remaining survey sites, higher periphyton levels between 490-825 mg/m^2 chlorophyll *a* were observed in a slightly lower range of 0.06-0.18 mg/l TP. Telford seems to be implying that because lower TP concentrations on September 24, 2014 are associated with higher algal concentrations and higher TP are associated with lower algal concentrations that there is no relationship between the TP in Indian Creek and algal concentrations. However, periphyton growth can uptake TP from the water column which can result in higher concentrations of algae growth concurrent with lower TP concentrations (Dodds 2003). Again, Telford's conclusions are not supported by the data presented.

To fully understand the relationship between TP concentrations and algal blooms within Indian Creek, EPA would need to understand the length of growth time for the algal blooms present on September 24, 2014, the TP levels that occurred over that time to support the growth, the TP discharge from all point sources, and any rain events that might have delivered TP to the Indian Creek system without also causing scouring events that would reduce algal levels. To assist in understanding the rain events within the Indian Creek watershed and therefore the algal scouring and TP that could have been delivered to the watershed during rain events, EPA looked to the National Climate Data Center (NCDC) found online[5] which presents precipitation data in the Indian Creek watershed and its surrounding area for the month of September 2014. EPA notes that the Kleinfelder Report has mischaracterized the precipitation history for the Indian Creek watershed in September 2014. The Kleinfelder Report estimated the frequency and amount of precipitation for the Indian Creek watershed using the Quakertown, PA precipitation gauge which is *outside* of the Indian Creek Watershed by approximately seven miles. Using the Quakertown gauge data, the Kleinfelder Report estimates there were 59 days of dry weather

[5] https://gis.ncdc.noaa.gov/map/viewer/#app=cdo&cfg=obs&theme=ghcn

before the monitoring date of September 24, 2014, thereby suggesting that algae was growing for 59 days with no stormwater runoff as a source of TP to the system. However, the NCDC presents more accurate precipitation data for the Indian Creek watershed and its surrounding area for the month of September 2014. The NCDC provides precipitation data from the Souderton gauge, which is *within* the Indian Creek watershed. Figure 3 depicts the locations of the precipitation gauges in Quakertown and Souderton. Figure 3 also depicts the location of the closest U.S. Geological Survey (USGS) flow gauge 01472810 located in the East Branch Perkiomen Creek near Schwenksville, PA, downstream of Indian Creek watershed. Attachment B includes the precipitation data for Souderton, PA and Quakertown, PA that were obtained from NCDC.

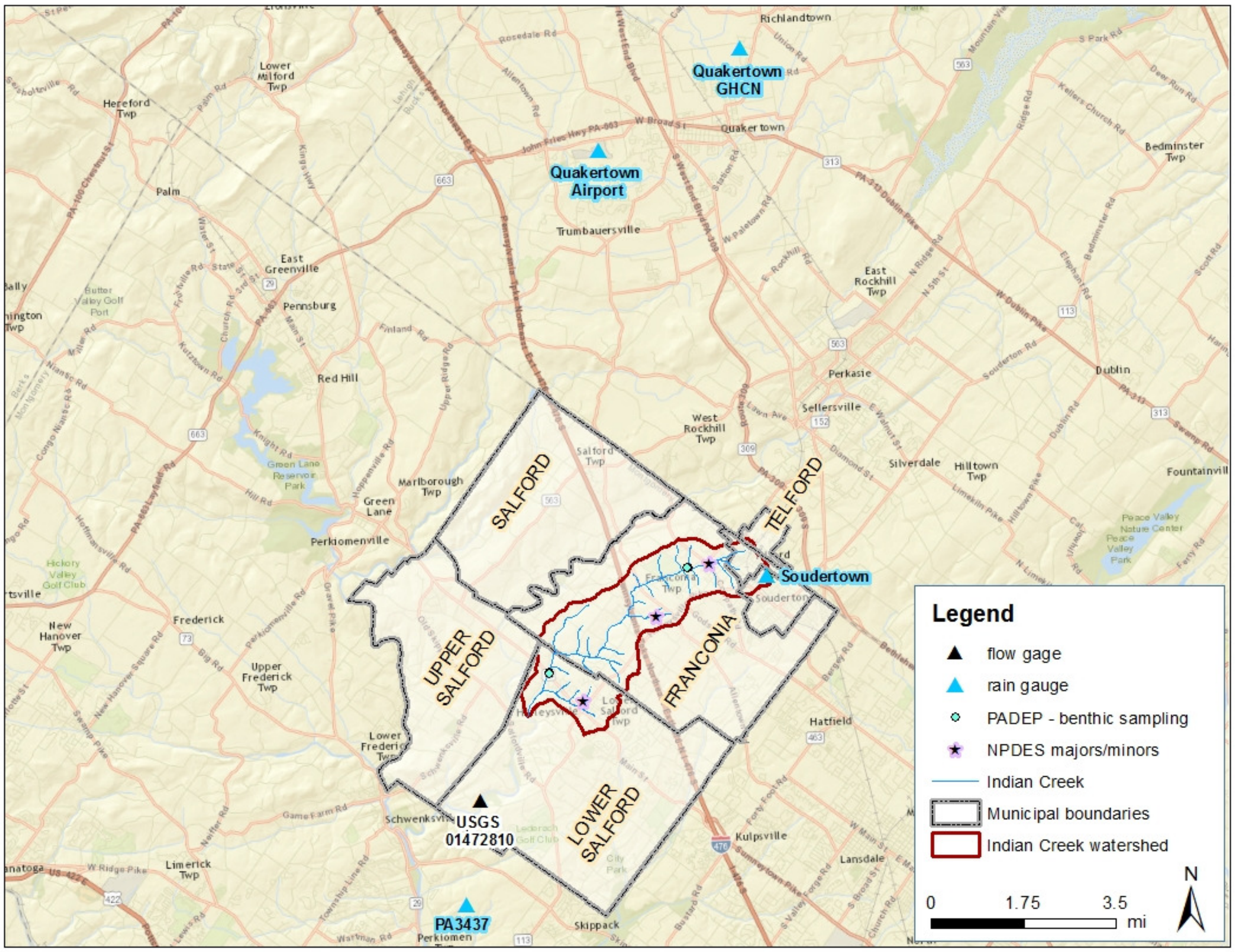

Figure 3. Locations of precipitation and hydrologic flow gauges near the Indian Creek watershed.

Because storm events can be quite localized, the Souderton precipitation data presents a more accurate picture of the rain events within the Indian Creek watershed. Contrary to the Kleinfelder Report's assumption of 59 dry days before its September 24th survey, the Souderton gauge data indicates that a major rainfall event (2.01 inches measured) occurred on September 7, 2014, 17 days before the survey. Two additional smaller rain events occurred on Sept 14, 2014 (0.35 inches of rain) and September 16, 2014 (0.27 inches of rain). This data is corroborated by data in Figure 4, which presents the stream flow discharge at the USGS station 01472810. The USGS stream gauge data shows that a peak flow discharge of nearly 400 cubic feet per second (cfs) occurred shortly after the September 7th rain event and other elevated flows occurred between September 13th and September 25th. The median daily discharge at USGS station 0101472810 over 24 years is approximately 60 cfs while the base flow discharge surrounding the peak flow discharge of 400 cfs was approximately 20 cfs. This peak flow discharge was over six times larger than the median daily discharge and approximately 20 times larger than the adjacent base flow.

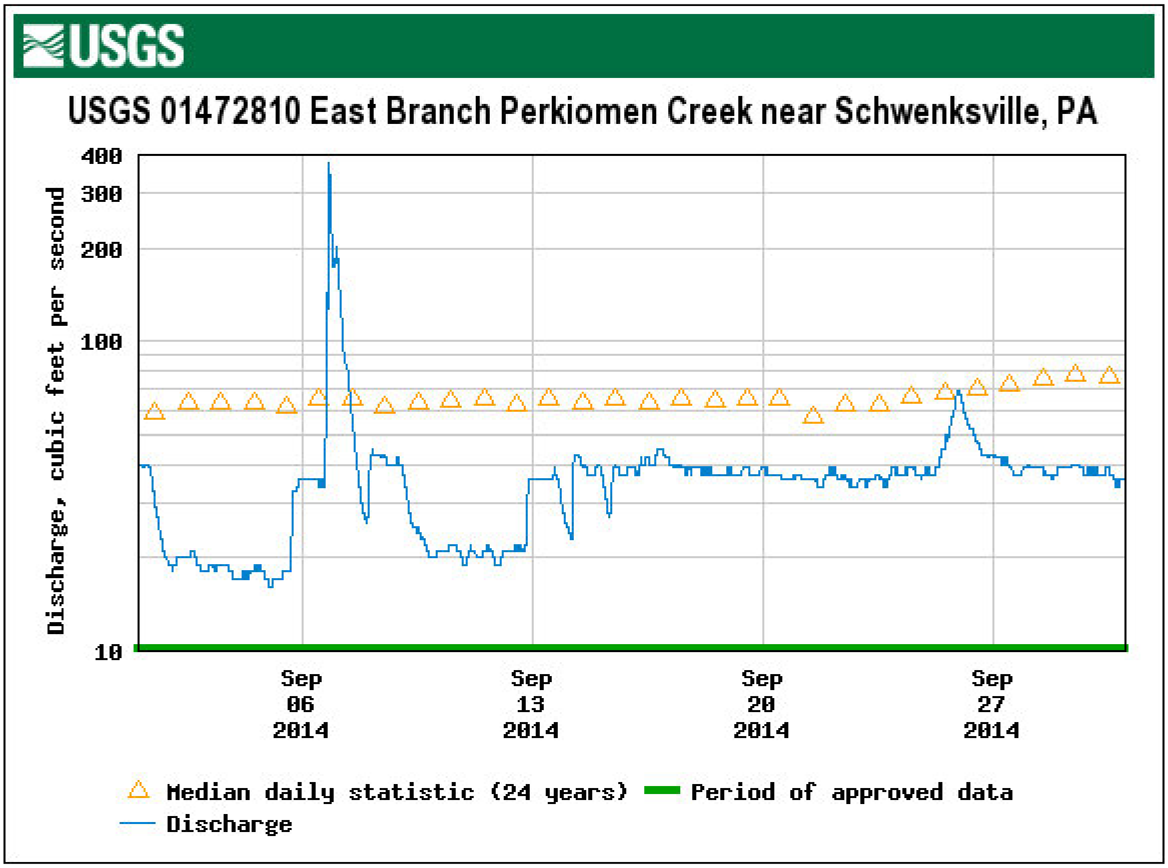

Figure 4. Stream flow discharge for USGS 01472810 flow gauge for the East Branch Perkiomen Creek near Schwenksville, PA for September 2014.

The importance of accurately characterizing rainfall in the period before the Kleinfelder monitoring day is twofold. First, it is important to understand large storm events causing higher instream flows that can wash away (scour) the periphyton. According to PADEP's 2013 *Field Protocol: Periphyton Standing Crop and Species Assemblages* (PADEP 2013a), monitoring for periphyton should occur following at least 14 days of stable low flow conditions (dry weather). The protocol states that significant rain events may cause high flows that scour the periphyton from rocks and recommends that as much as four weeks of stable flow may be necessary for periphyton communities to regain biomass and species diversity (Biggs 2000). The protocol also notes that Biggs 2000 estimates scour inducing flows as five to six times the average flow for a given time period. As noted above, the peak flow discharge caused by the September 7th rain event was over six times larger than the median daily discharge and approximately 20 times larger than the adjacent base flow. Therefore, the September 7th rain event was large enough to scour algae in the Indian Creek watershed. EPA concludes that the September 24th periphyton standing crop, presented in the Kleinfelder Report grew between September 7th and September 24th. The rain events on September 14th and 16th were smaller than on September 7th, and it is not known the extent to which the increased flows associated with those events were sufficient to scour periphyton in Indian Creek. However, because of the large standing crop of algae on Sept 24th, EPA will presume that the September 14th and 16th rain events were likely not sufficient to scour all of the algae as likely occurred during the scouring event of September 7th.

It is not known how much TP entered Indian Creek through stormwater runoff and MS4 discharges during each rain event or what levels of TP were delivered to the stream between September 7th and September 24th (the sample day). Contrary to Telford's conclusion that excessive plant growth is occurring in Indian Creek regardless of TP concentrations, the Kleinfelder Report and NCDC present data that show that (1) significant plant growth occurred over a 16-day period (not 59), that (2) three rain events occurred during the 16-day period that could have delivered significant TP loads to the stream via stormwater runoff, and (3) at the end of that 16 day period, the TP concentrations were elevated. EPA notes that, <u>but for the presence of excess nutrients (in this case, TP), there would be no excess algal growth</u>. While there may be environmental factors that can influence the impact of excess nutrients, the underlying cause of the excess algal growth is the excess nutrients, as confirmed by the data in the Kleinfelder Report. Based on this information, EPA concludes that the TP levels throughout Indian Creek are sufficient to support a large standing crop of algae.

Telford also concludes *"Periphyton remained very high on the unnamed tributary where the now discontinued Pilgrim's Pride discharge had been located. Periphyton reductions are not occurring as predicted in the TetraTech modeling, confirming that model is not properly calibrated. Even zero discharge cannot control periphyton growth."* The Kleinfelder Report included a survey site (PP-Iu) within the unnamed tributary to Indian Creek where Pilgrim's Pride was located. Table 3 of the Kleinfelder Report shows survey location PP-Iu had a high periphyton chlorophyll *a* density of 689 mg/m^2 and a elevated TP concentration of 0.178 mg/l. While EPA agrees with Telford that the loss of discharge from the Pilgrim's Pride facility will help reduce nutrient levels in the waterbody, this unnamed tributary continues to be impacted by nutrients from stormwater runoff and MS4 discharges that are causing elevated TP and excess algae. As seen in Figure 5, the Franconia MS4 has land uses upstream of PP-Iu including Low Intensity Residential (16.4%), High Intensity Residential (12.3%), High Intensity Commercial/Industrial (14.2%), Paved Roads (15.5%), and Agriculture/Pasture (34.4% combined). As mentioned previously, three rain events occurred between September 7th to September 24th and during those rain events, runoff from the MS4 would have contributed to the elevated TP concentrations over the 16 day periphyton growth period seen at survey location PP-Iu. Therefore, Telford's assertion that there is zero (0) discharge of TP occurring in the unknown tributary to Indian Creek is inaccurate. As noted in the Indian Creek TMDL and Table 1 above, MS4 discharges (which also present in this unknown tributary) are a significant source of TP to the Indian Creek watershed and as represented in the TMDL, reductions are needed from the MS4 as well as Pilgrim's Pride before water quality standards can be attained.

Description	Area (m^2)	Drainage Area Percentage
Low Intensity Residential	110,700	16.4%
High Intensity Residential	82,800	12.3%
High Intensity Commercial/Industrial	95,400	14.2%
Paved Roads	104,400	15.5%
Bare Rock/Sand/Clay	16,200	2.4%
Deciduous Forest	20,700	3.1%
Shrub/Scrub	6,300	0.9%
Grassland/Herbaceous	5,400	0.8%
Pasture	228,600	34.0%
Agriculture	2,700	0.4%
TOTAL	**673,200**	**100.0%**

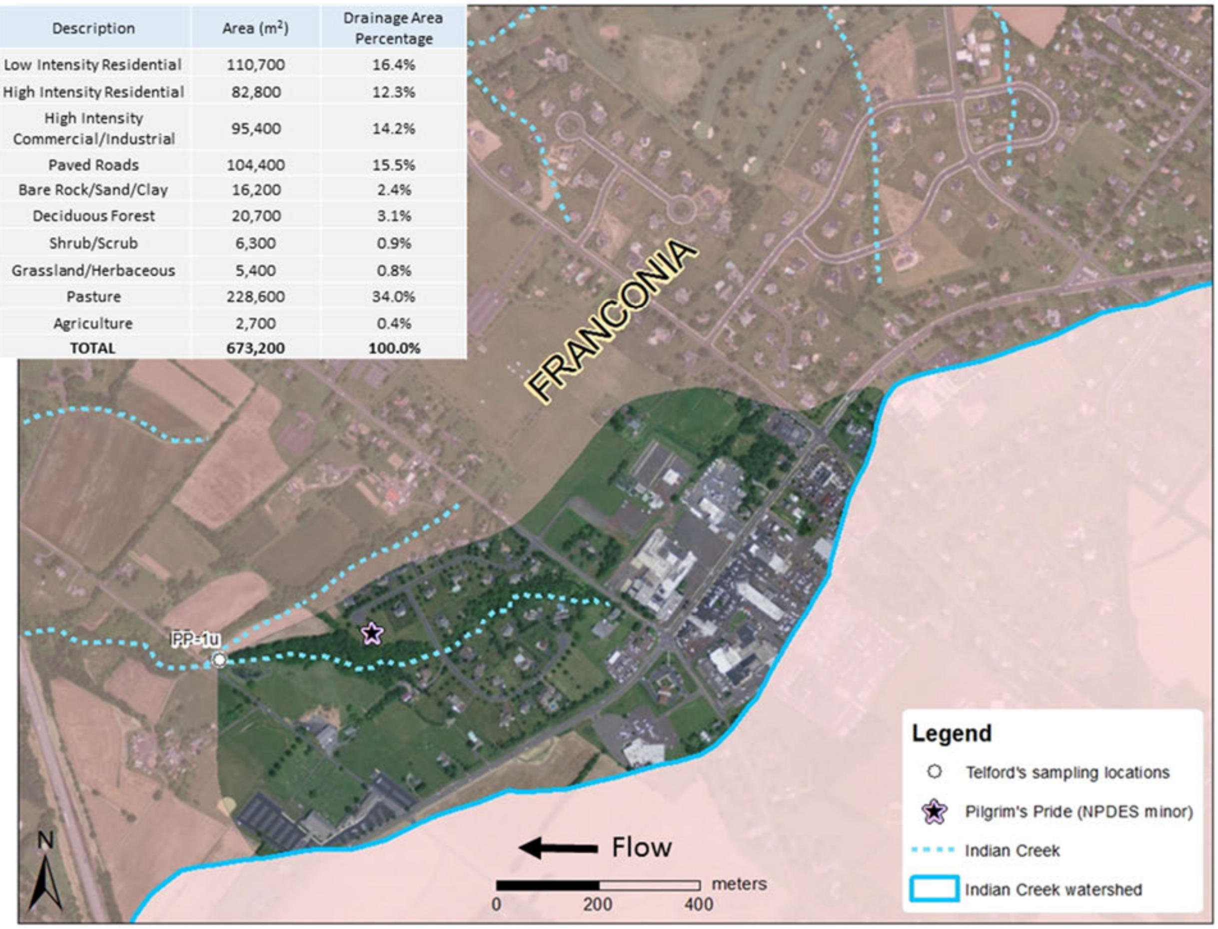

Figure 5. Map of the unnamed tributary to Indian Creek drainage area upstream of the Kleinfelder sampling location PP-Iu including the drainage area percentage of landuses and MS4 boundaries.

In addition, EPA disagrees with Telford's conclusion that one day of data depicting the elevated TP and periphyton levels in the unnamed tributary following closure of Pilgrim's Pride demonstrate that the Indian Creek nutrient TMDL model was improperly calibrated. To the contrary, the TMDL modeled all relevant sources of TP in the watershed, including land sources and their discharges during rain events. As described in Section 4.2 of the Indian Creek TMDL, the nutrient TMDL model was properly calibrated for hydrodynamic and water quality parameters. The model was calibrated using an 8-year time period that captures any seasonal variations in the watershed with a range of precipitation and stream flow conditions being represented. Calibration plots for the East Branch Perkiomen Creek are presented in Figures 4-4 and 4-5 of the TMDL report.

Contrary to Telford's conclusion, the data presented in the Kleinfelder Report actually supports the TMDL's conclusions that TP from all sources, including the WWTPs and MS4s, would need to be reduced to ensure attainment of water quality standards within the Indian Creek watershed. Even though the Pilgrim's Pride facility discharge has been eliminated, further nutrient reductions from the remaining sources, including MS4s, were demonstrated by the modeling to be necessary to ensure this unnamed tributary attains water quality standards.

Telford makes one final conclusion based on the Kleinfelder report: *"Chlorophyll-a levels are affected by the percentage of canopy. The three periphyton survey samples at 0% unshaded sites averaged 372mg/m² chl-a while the three survey samples at sites of at least 70% unshaded averaged 616 mg/m².*"

Based on the data included in the Kleinfelder Report, EPA agrees with Telford that three of the six Kleinfelder survey locations appear to be completely shaded (i.e., 100% shaded) including IC-2s, IC-4s, and IC-5s. The other three survey locations were either mostly unshaded (i.e., 70% unshaded) or completely unshaded (100% unshaded), including IC-1u, IC-3u and PP-Iu. Table 3 of the Kleinfelder Report shows the results of this survey, including periphyton chlorophyll *a* densities, TP concentrations, and percent unshaded. In addition, EPA does not dispute Telford's assertion that chlorophyll *a* levels are affected by shade. Indeed, as noted in Figure 6 below and the Indian Creek TMDL report and its endpoint documents, light, flow, substrate, temperature and other factors can impact algal growth. However, given that the very data that Telford submitted to EPA for its consideration confirms elevated TP levels and chlorophyll *a* levels well above nuisance levels even in 100% shaded areas, the data continue to support the conclusion that Indian Creek is impaired by elevated TP levels, regardless of the tree canopy, and that TP reductions are needed from all sources regardless of the levels of shade for Indian Creek to attain WQS.

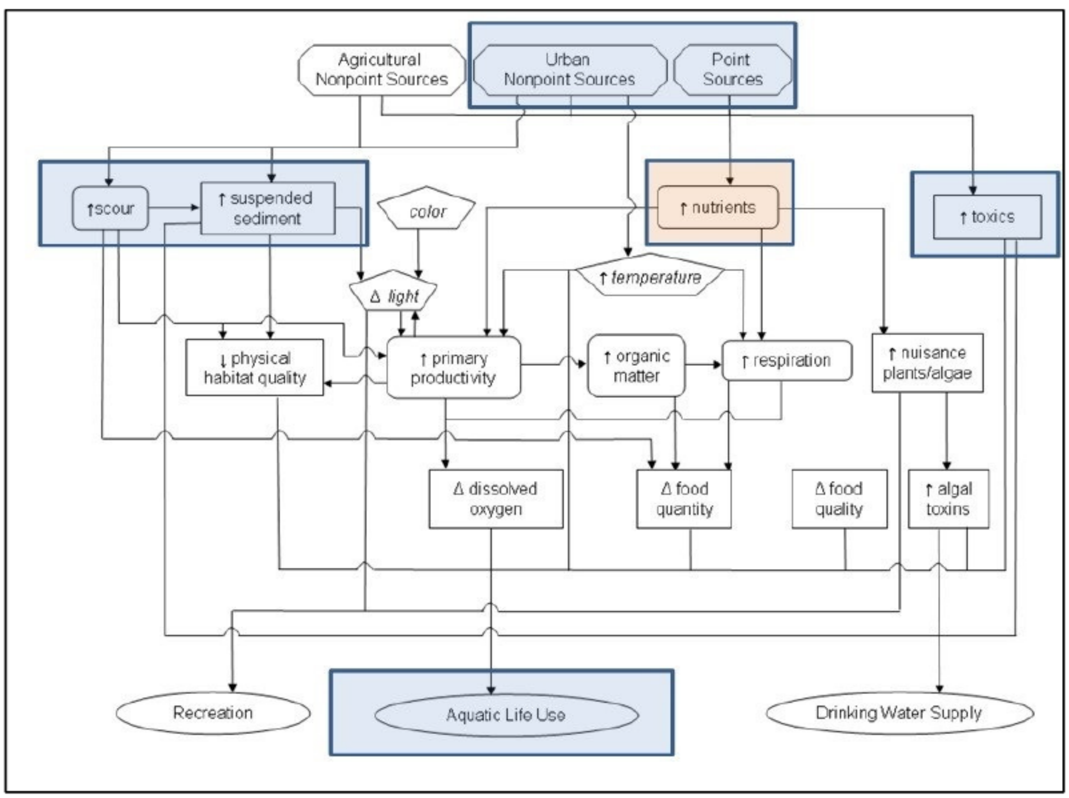

Figure 6. Detailed conceptual model of the causal relationship between nutrients and responses in streams (after USEPA 2010)

Telford's Conclusion #3:
"Numerous scientific studies confirm that periphyton control via TP reduction is impossible, except at extremely low levels of TP that are not attainable in this system (less than 10-20 µg/l of soluble reactive phosphorus).

The studies confirm that light limitation is the only viable means of controlling periphyton growth in systems such as these. Even if the 40µg/l TP goal of the TMDL was met, the excessive algae would continue unabated; other improvements (i.e. canopy restoration) will be necessary to improve the condition in Indian Creek. Moreover, if such habitat restoration is completed there is no need to reduce TP."

Response to Conclusion #3:
Telford presented a summary of 11 articles that discuss the relationship between algal growth and sunlight. Telford concluded from these articles that "periphyton control" by reducing TP is impossible except at extremely low levels of TP that Telford further asserts are not attainable (10-20 µg/l of soluble reactive phosphorus). Telford concludes that light limitation is the only viable means of controlling algae growth.

The first flaw in Telford's reasoning is Telford's choice of soluble reactive phosphorus as the appropriate measure. Soluble reactive phosphorus is a subset of total phosphorus. Total phosphorus (TP) is a measure of all the forms of phosphorus, dissolved or particulate, that are found in a water sample. Soluble reactive phosphorus (SRP) is a measure of orthophosphate, the filterable (soluble, inorganic) fraction of total phosphorus. There is no way to extrapolate TP levels from SRP levels without directly analyzing a particular monitoring sample. Therefore Telford's assertion that TP levels are extremely low based on 10-20 µg /L soluble reactive phosphorus cannot be verified.

More importantly, while EPA does not disagree with Telford that light has an influence on algal growth (refer to Figure 6 which indicates that light, flow, substrate, temperature are all factors that play a role in how excess nutrients may impact a watershed), the available data and literature demonstrates that TP levels are the main driver in periphyton growth in a waterbody (USEPA 2000, Welch 1992, Van Nieuwenhuyse and Jones 1996, Dodds et al. 1997, Chetelat et al. 1999, USEPA 2010, and Hausmann, et al. 2016). While relatively dense algal blooms may occur where there is no shade, the food that causes the algae to grow, in both shaded and unshaded areas is nutrients, in this case TP. Further, a lack of trees by itself, without excess TP, would not cause nuisance algal growth. While EPA agrees that tree canopy restoration may be a good best management practice (BMP) to control light and temperature and therefore help reduce algal growth, it is just one of many actions that could be taken to reduce the impact of nutrients within the Indian Creek watershed.

Telford specifically presented as Exhibit 3 an article entitled "Mercury Falling: How a facility upgrade intended to reduce algal growth resulted in unintended (yet favorable) consequences" from *Water, Environment and Technology Journal*. The article stated that, the South River WWTP in Virginia reduced its phosphorus levels to from 4.0 mg/l to 0.12 mg/l and nitrogen levels from 17 mg/l to 1.17 mg/l. The article further explains that while WWTP reductions were successful, nonpoint source contributions of nitrogen were still discharging to the stream. The article notes that "algal growth did not decrease significantly" as a result of the WWTP reductions and offered a few hypotheses as to why. First, the article notes that the EPA recommended nutrient criteria for the ecoregion was 0.01 mg/l phosphorus and 0.31 mg/l nitrogen. Even after the WWTP upgrades, the nitrogen levels were twice this recommendation and the phosphorus levels were 3 to 4 times higher. The article notes that reductions from nonpoint sources would need to be achieved to meet water quality goals. The article hypothesizes that nitrogen in the form of nitrite and ammonia was available to the algae that may have spurred algal growth. EPA does not understand how Telford intends this article to be used by EPA but we agree with the article that the South River's algal growth is likely due to nutrient concentrations from nonpoint sources and that nitrogen, nitrate and ammonia may have been causing the algal growth. Similarly, the Indian Creek watershed is impacted by WWTPs (with the Telford WWTP being the largest) as well as land sources (MS4s, runoff from agriculture and residential lands). In accordance with the TMDL, all reductions from all sources would need to be achieved to meet the TMDL endpoint of 0.04 mg/l TP.

Based on the presented articles by Telford, EPA concludes that nutrients (whether phosphorus and/or nitrogen) cause algal growth. Many of the articles presented evidence that light and other environmental factors can influence algal growth. No article suggested that excessive algae growth would continue unabated at TP levels below 0.04 mg/l.

Telford's Conclusion 4:

"In summary, Telford believes this new information confirms to a scientific certainty that the 40 µg/l instream TP target in the Indian Creek TMDL 1) is unachievable given the background concentrations of TP and 2) would not eliminate the impairments in Indian Creek, even if it were achieved. The literature confirms that it is only through light limitation, the presence of grazers and periodic scouring events that periphyton growth is reduced in small stream systems such as Indian Creek. In fact, we would expect that extensive stormwater controls, proposed by EPA, will cause greater periphyton growth to occur in this system by reducing the number of scouring events and allowing filamentous growth to persist. That is, this new information not only confirms that the TMDL's present approach will not just misdirect local resources on an ineffective remedy, it will, in the end, most likely cause more harm than good."

Response to Conclusion #4:

All data and analysis presented by Telford continues to support the TMDL in Indian Creek for TP and Pennsylvania's 303(d) impairment listing for Indian Creek. As stated in Response to Conclusion #1, the TP levels upstream of the WWTP are not natural background, but rather caused by all sources in the watershed. Telford provided no evidence that the 40 µg/l instream TP would not eliminate nutrient impairments. (See Responses to Conclusion #2 and #3). EPA agrees that many natural factors and factors influenced by human activity can combine to determine rates of plant growth in a waterbody. But a key factor is whether or not sufficient phosphorus (or nitrogen) is present to support plant growth in a waterbody. The fact that Indian Creek is impaired by nutrients is not in question. In fact, Telford admits in several places that excessive algal growth (i.e., high primary production) is occurring in Indian Creek.

PADEP defines nutrient impairment in PADEP's 2013 assessment methods as the "*Presence of excessive daily fluctuations in dissolved oxygen and pH caused by high primary production* *resulting from elevated levels of phosphorus and/or nitrogen. Biological impairment may occur based on general (narrative) criteria violations. Accompanying violations of 93.7 specific water quality criteria for dissolved oxygen or pH are not required*." (PADEP 2013b)

EPA's March 21, 2014 reconsideration decision previously addressed whether Indian Creek is nutrient impaired on pages 3-8. In the 2014 reconsideration, EPA confirmed that all data to date support PADEP's identification of a nutrient impairment in Indian Creek in *Pennsylvania Integrated Water Quality Monitoring and Assessment Reports* (IR) from 2004-2012. That data included evidence that Indian Creek's macroinvertebrate community is impaired, as well as evidence of the existence of dense algal blooms, severe swings in dissolved oxygen (DO) and pH, oxygen saturation levels and elevated nutrient levels. Pennsylvania's 2014 IR Category 4a list (impaired but has an approved TMDL) retained PADEP's identification of a nutrient impairment in Indian Creek.

Since EPA's 2014 reconsideration decision, PADEP recently shared with EPA continuous monitoring data gathered in 2014 to 2015. PADEP used water quality sondes, which were deployed at two in-stream locations within Indian Creek and remained, in place to gather continuous data of pH, DO, temperature and conductivity. The two monitoring locations were at Bergey Road and at Route 63 in the Indian Creek watershed (see Figure 2). Attachment C provides graphs of the pH, DO, temperature and conductivity data collected at the two monitoring sites. In addition, Figures 7 and 8 provide graphs of the continuous pH and DO data, respectively, taken at the Route 63 monitoring station in 2014. The graphs clearly depict diurnal swings of pH and DO indicative of algae photosynthesizing (primary production) instream during the day and respiring at night. In addition, the data indicated several exceedances of pH and DO water quality standards during the growing season of 2014. Pennsylvania's standards cite that pH should be between 6.0 and 9.0 inclusive and DO for flowing waters should be a minimum of 5.0 mg/l. These graphs show several instances above the 9.0 maximum for pH and below the 5.0 mg/l minimum for DO. In addition the graphs depict DO diurnal swings indicative of high primary production from algal blooms that negatively impact aquatic life.

High pH levels are indirectly caused by the relationship between high nutrient levels and algal growth. During photosynthesis, algae utilize carbon dioxide, resulting in high pH conditions (Sawyer et al. 1994). In water, carbon dioxide gas dissolves to form soluble carbon dioxide, which reacts with water to form undissociated carbonic acid. Carbonic acid then dissociates and equilibrates as bicarbonate and carbonate. Generally, as carbon dioxide is used up in photosynthesis, pH rises due to the removal of carbonic acid (Horne and Goldman 1994). The pH swings and associated high pH levels in Indian Creek are further evidence indicating excess primary productivity (algal growth) in the stream is occurring. Based on this new data from PADEP and EPA's previous analysis in its 2014 Reconsideration, EPA remains convinced that Indian Creek is impaired by nutrients.

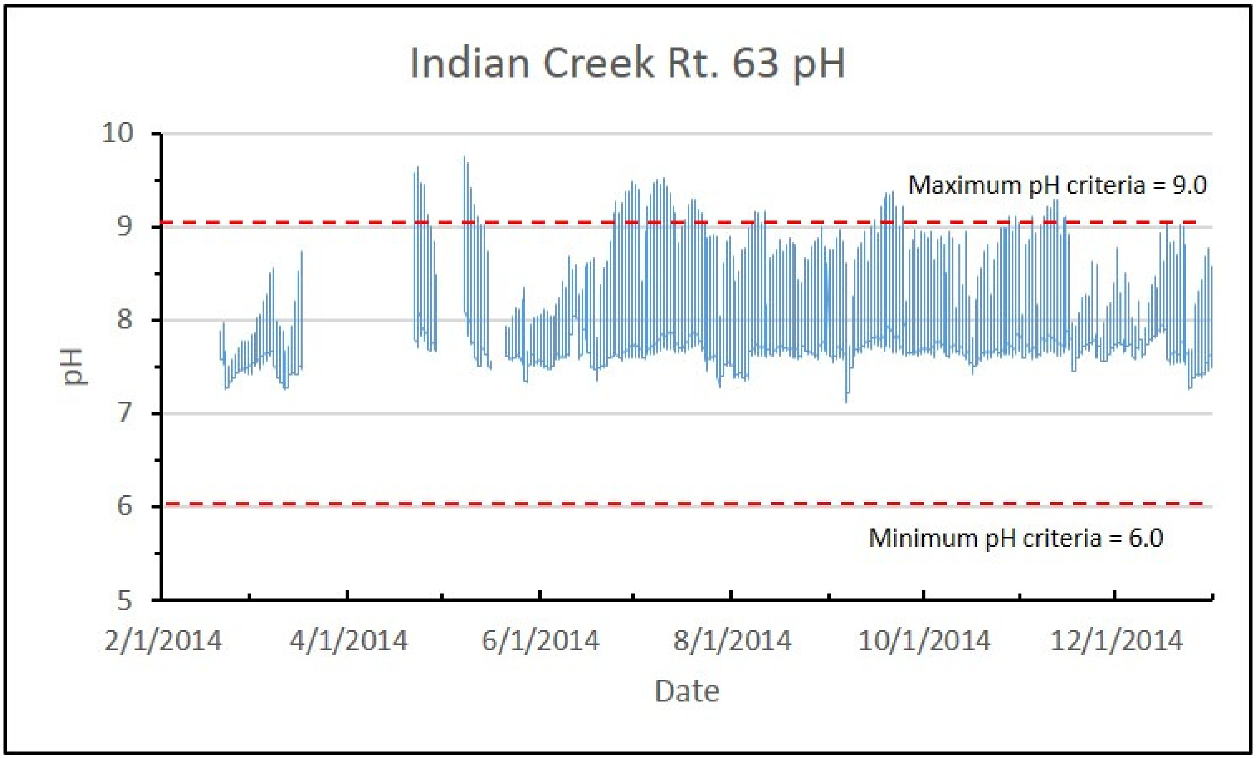

Figure 7. – pH continuous monitoring at Route 63 Indian Creek - 2014

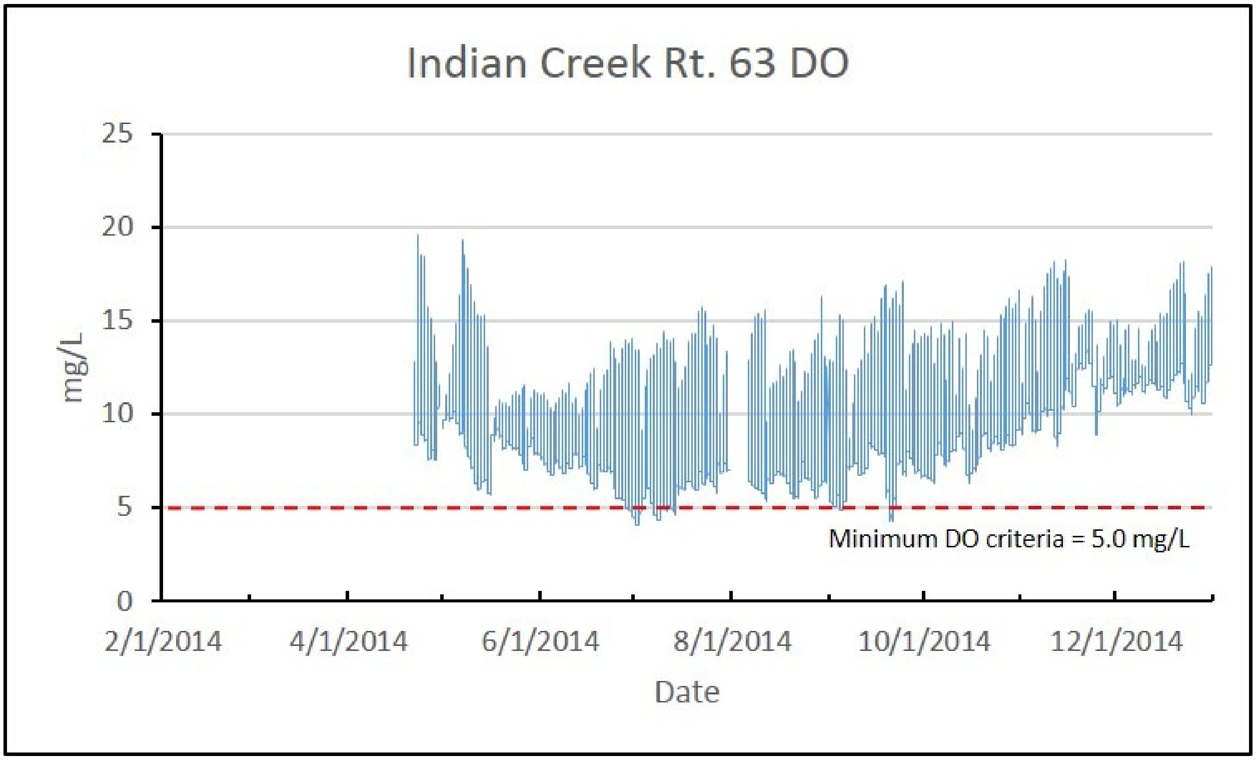

Figure 8. DO continuous monitoring at Route 63 Indian Creek - 2014

Finally in an August 12, 2014 Letter from Mr. Mark D. Fournier, Borough Manager, Telford Borough Authority (Telford) to EPA Region 3 Water Protection Division Director Jon Capacasa (Telford Borough Authority 2014), Telford asked clarification on three questions:

> *(1) What are the aquatic life and/or excessive plant growth impairment thresholds (quantitative ecological targets for invertebrates and plant growth) that served as the basis for deriving the nutrient endpoint used in the TMDLs?*
>
> *(2) What non-nutrient, chemical impairment thresholds did EPA use to assess compliance with Pennsylvania's narrative criteria in the Indian Creek TMDLs?*
>
> *(3) As Telford's watershed restoration plan intends to eliminate "nuisance plant growth" and ensure compliance with applicable DO/pH criteria, what instream plant growth level did EPA use in setting the TMDLs to a) eliminate nuisance algal growth and b) achieve the DO/pH numeric criteria?*

EPA's Response to the three questions:

Telford's Question #1 asks EPA to clarify the aquatic life and/or excessive plant growth impairment thresholds (quantitative ecological targets for invertebrates and plant growth) that served as the basis for deriving the nutrient endpoint used in the TMDL. PADEP's identification of a nutrient impairment in Indian Creek in 303(d) lists and IRs from 2004-2014 has been confirmed by data that provides evidence that Indian Creek's macroinvertebrate community is impaired, as well as evidence of the existence of dense algal blooms, diurnal swings in dissolved oxygen (DO) and pH, oxygen saturation levels and elevated nutrient levels. EPA has concluded in *Development of Nutrient Endpoints for the Northern Piedmont Ecoregion of Pennsylvania: TMDL Application* (USEPA 2007) and *Development of Nutrient Endpoints for Northern Piedmont – Follow Up Analysis* (USEPA 2012) that there is an increased likelihood of indirect adverse effects on benthic organisms due to excess algae, DO and pH swings, and other stressors caused by elevated nutrients. These endpoint documents present many lines of evidence including the statistical approach of "conditional probability" to predict such indirect effects to establish the 0.040 mg/l TMDL's endpoint for TP. Please refer to these endpoint documents for a full explanation of the aquatic life and/or excessive plant growth impairment thresholds (quantitative ecological targets for invertebrates and plant growth) that served as the basis for deriving the nutrient endpoint used in the TMDL.

Figure 6 above provides a detailed conceptual model of the effects of nutrients on an aquatic ecosystem. As illustrated in Figure 6, nutrients (along with other factors such as light, temperature and flow) affect aquatic systems in diverse ways. Increased concentrations of nutrients may increase plant, algal and microbial growth within a waterbody. Due to algal photosynthesis during the day and respiration at night, DO and pH levels may swing from high to low values throughout a 24-hour period, with possible DO and pH water quality standards excursions during that time period. In addition, the increase of plant/algal and microbial growth may affect the habitat and food sources in a water system, changing the aquatic life to those that can compete and survive in that type of ecosystem. The change in DO, pH, food sources, and habitat can exert an effect that alter and degrade the aquatic life species to more pollutant tolerant species.

As discussed in Responses to Conclusions #2 and #3 above, EPA is drawing upon literature values that report nuisance or excessive periphyton biomass is considered to occur when maximum chlorophyll exceeds 150 to 200 mg/m^2 (Dodds et al. 1998, Suplee et al. 2009), although concentrations from 50 to 100 mg/m^2 have also been indicative of nuisance concentrations (Horner et al. 1983, Nordin 1985, Welch et al. 1988, and Hausmann et al. 2016).

Telford's Question #2 asks if EPA assessed compliance with Pennsylvania's narrative criteria in Indian Creek TMDLs for non-nutrient, chemical impairment thresholds. EPA did not assess such noncompliance with Pennsylvania's narrative criteria in development of the Indian Creek TMDLs. As part of the Integrated Reporting process, PADEP evaluates all readily available water quality data and information and compares that data and information against applicable narrative and numeric water quality criteria. The TMDLs were based on PADEP's assessment of the cause of impairment found in their Section 303(d) list of impaired waters. Indian Creek is identified on Pennsylvania's 303(d) lists as impaired by nutrients due to municipal point sources and siltation/sediment due to agriculture, small residential runoff and urban runoff/storm sewers. Based on the nutrient and sediment listings, EPA developed TMDLs to address those two causes of impairments. Additional TMDLs may be warranted in the future for any other pollutants that may be impairing the waterbody as identified by PADEP. As described above in Response to Conclusion #4, subsequent instream data and analysis by PADEP as well as data and information provided by Telford confirm the nutrient impairment within the Indian Creek watershed.

Telford's Question #3 asks EPA to clarify the instream plant growth level EPA used in setting the TMDL to eliminate nuisance algal growth and achieve the DO/pH numeric criteria. To be clear, EPA based its TMDL on an instream water quality endpoint of 0.04 mg/l of TP and if that endpoint is achieved, the TMDL predicts that Indian Creek watershed will no longer experience DO and pH water quality standards exceedences, diurnal swings of DO and pH, nuisance algal growth and the associated changes in DO, pH, food sources, and habitat indirectly caused by excess nutrients. As described in EPA's March 21, 2014 reconsideration decision on pages 9-15, the endpoint identification methodology relied on a multiple (22) lines of evidence approach using frequency distribution based analyses, stressor-responses analyses, literature based values, and a mechanistic model. EPA then considered the resulting candidate values and applied a weight-of-evidence selection process to select the final endpoint. Based on results and recommendations of the 2007 and 2012 nutrient endpoint identification studies, EPA selected the TP endpoint for the Indian Creek TMDL of 40 µg/L (0.04 mg/l), applicable from April 1 – October 31. As discussed in the Response to Conclusion #4 above, EPA has also used evidence of diurnal swings in DO, oxygen saturation levels and pH criteria violations and elevated nutrient levels to determine that primary production (algal growth) is occurring due to nutrients. Additionally, EPA has found that the levels of pH and DO that exceed its water quality standard are indirectly caused by the relationship between high nutrient levels and algal growth (Sawyer et al. 1994; Horne and Goldman 1994). Please refer to the following reports previously provided to Telford for additional information regarding the ecological impairment thresholds used in Indian Creek that answer the question:

- EPA's November 20, 2007 report entitled, *Development of Nutrient Endpoints for the Northern Piedmont Ecoregion of Pennsylvania: TMDL Application* (USEPA 2007)
- EPA's July 18, 2012 report entitled, *Development of Nutrient Endpoints for Northern Piedmont – Follow Up Analysis* (USEPA 2012)
- EPA's March 21, 2014 *Reconsideration Decision and Rationale Nutrient and Sediment TMDLs for the Indian Creek Watershed, Pennsylvania*. (USEPA 2014)

EPA Decision on Indian Creek Nutrient TMDL Reconsideration

For the nutrient TMDL, EPA has considered the additional information and comments received from Telford, reviewed the TMDL in light of that information, and determined that the nutrient TMDL remains technically sound. EPA has not been presented with or reviewed any post-TMDL site-specific monitoring data or other evidence that would indicate that the waters are not impaired by excessive nutrients. EPA therefore denies Telford's request to withdraw the nutrient TMDL.

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